Woodland Caribou In Ontario

Background To A Policy

Ministry of Natural Resources
Ontario

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EXECUTIVE SUMMARY

Woodland caribou are a true symbol of Ontario's northern heritage and wilderness. They once inhabited all of Ontario south to Lake Nipissing, but since European settlement their distribution has steadily receded northward to its present southern limit of approximately 50 degrees latitude. The distribution is still shrinking. A few exceptions are remnant herds on the islands and northern shore of Lake Superior.

The Ontario public is generally unaware caribou exist in the province. The tourism and scientific value of caribou is largely unrecognized. Native hunting of caribou occurs under Treaty rights whereas non-Native hunting of caribou was prohibited in 1929.

Management of the species and its habitat in Ontario has been minimal. This document presents background information to a policy for woodland caribou that will strengthen awareness and management efforts. It summarizes the status, biology, issues and management of Ontario caribou.

No comprehensive program for caribou inventory exists in Ontario. Provincial population estimates have been made twice, once in 1965 and again in this document. The present population is estimated to be approximately 15,000 animals.

Caribou take longer to reach sexual maturity than other members of the deer family and do not have multiple births. This low reproductive potential, their diet and adaptations to survive winter, allow them to occupy the tundra and mature boreal forest niche. Conversely, moose and white-tailed deer occupy the young deciduous or mixed forest niche.

Predation and loss of mature coniferous forest are serious threats to Ontario caribou, especially where moose, deer and wolf numbers increase to relatively high levels in caribou range after logging. Forestry operations, high predator numbers and a parasite carried by white-tailed deer can impact negatively on caribou. Poaching and excessive Native hunting can also threaten the resource.

Current Ontario issues are: lack of awareness of the caribou resource; the shrinking distribution of caribou; mitigation of forestry effects on caribou; re-evaluation of the sport hunting closure; the economic value of caribou to Native people through subsistence use versus trophy sport hunting; predator management; and caribou relocations.

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1.0 INTRODUCTION

This document provides background information for the development of a provincial policy for woodland caribou in Ontario. It is intended to provide the public and professionals with a summary of the status, biology, issues and management of Ontario caribou. It is based on results of a comprehensive literature review and analysis of caribou data.

The document is organized into four principle sections: a summary of current knowledge about caribou; a brief history of caribou management efforts in Ontario; a synopsis of major issues relating to Ontario caribou; and an appendix of published and unpublished information.

Ontario has been managing caribou in the absence of a provincial policy. This lack of direction has hampered an organized approach to management. Public awareness of the resource is poor at a time when caribou are increasingly threatened by a variety of factors. A stimulus is needed to increase public and government awareness of the value of caribou. It is the purpose of this document to support a provincial policy that will provide for sound management of the resource.

2.0 THE RESOURCE AND ITS HABITAT

2.1 Taxonomy and Description

The caribou is a medium-sized member of the deer family, Cervidae. It is a ruminant of the Order Artiodactyla; in other words, a mammal with a four compartment stomach and cloven hooves (Banfield, 1974). All races of caribou and reindeer belong to one species, (*Rangifer tarandus*) (Banfield, 1961). The caribou of Ontario are all considered woodland caribou (*R. t. caribou*), one of five sub-species present in North America.

Woodland caribou are larger, darker and less migratory than barren-ground caribou (*R. t. groenlandicus*) with which people are more familiar. Coloration varies slightly with age, sex and season, but is usually dark brown with a white neck and ventral mane, white groin and rump. The legs are brown with narrow white 'socks' above the hooves. The trunk and head are slightly elongated, and the nose is large with a square muzzle. Adult bulls weigh 180-270 kg (400-600 lbs.), while adult cows weigh 90-140 kg (200-300 lbs.) (Bergerud, 1978). Generally, both sexes grow antlers. Bulls grow large massive antlers with erect spreading main beams, prominent 'bez' tines that are forward hand-like branches of the main beams, and palmate 'brow' tines that point forward over the nose. Cows usually have smaller antlers that are variable in shape, but some cows never grow antlers. Bulls shed their antlers from November through March, while pregnant cows retain their antlers until May or June after calving.

Woodland caribou have specialized adaptations to withstand the rigors of cold, northern winters. Their winter pelage is very dense with long, brittle guard hairs and a close, crinkly underfur. The hair is not hollow as commonly thought, but filled with tiny air bubbles. This makes the coat highly insulative and very buoyant. The muzzle is well furred, and the hairless portion restricted to a small oval on the upper lip. The ears and tail are short and heavily furred. The unusually large feet have long dewclaws and crescent-shaped hooves which facilitate travel over snow-covered or boggy ground (Banfield, 1974). This gives caribou a very distinctive crescentic, four-toed track. The hooves are longer in winter than in summer, with fur over the pads, providing good traction, insulation and ability to dig through the snow (crater) for food.

2.2 Distribution and Numbers

2.2.1 Former Distribution

Woodland caribou once inhabited all of Ontario south to Lake Nipissing (Clarke, 1938; Snyder, 1938; Snyder *et al.*, 1942; deVos and Peterson, 1951). Their distribution steadily receded northward after European settlement in the late 1800's (deVos and Peterson, 1951; Cringan, 1956). It is still receding (Fig. 1).

During the late 1800's and early 1900's, the distribution of moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*) expanded northward (Snyder, 1938; Peterson, 1955; Cumming and Walden, 1970). It is likely the decline of caribou was due to a combination of factors; hunting, fire, land clearing, logging, increased predation due to increased densities of moose and deer, disease caused by brain worm (*Parelaphostrongylus tenuis*) and human disturbance (Klein, 1968; Anderson, 1971, 1972; Bergerud, 1974a; Geist, 1978; Bergerud *et al.*, 1984a).

2.2.2 Current Distribution

The southern limit of continuous caribou distribution in Ontario is presently a line of approximately 50 degrees latitude. South of this line there now remains only a few small scattered populations southeast of Geraldton, and on the islands, and northern shore of Lake Superior (Fig. 1).

2.2.3 Population Estimates

No comprehensive inventory program for woodland caribou encompasses all the caribou range of Ontario. However, a provincial population estimate can be constructed from recent systematic aerial transect surveys of large portions of the present range, plus various localized surveys. This method yields a current population estimate of approximately 15,000 caribou (Table 1).

Provincial population estimates have been constructed in the past. Simkin (1965a) estimated the provincial population to be 13,000 in 1965 based on systematic aerial surveys that sampled portions of northern Ontario from 1959 to 1964. Cringan (1956) estimated 7,200 caribou existed in Ontario based on a review of literature and small localized surveys. deVos and Peterson (1951) estimated there were between 1,300 and 3,000 caribou in Ontario, but admitted poor coverage of the important Patricia areas.

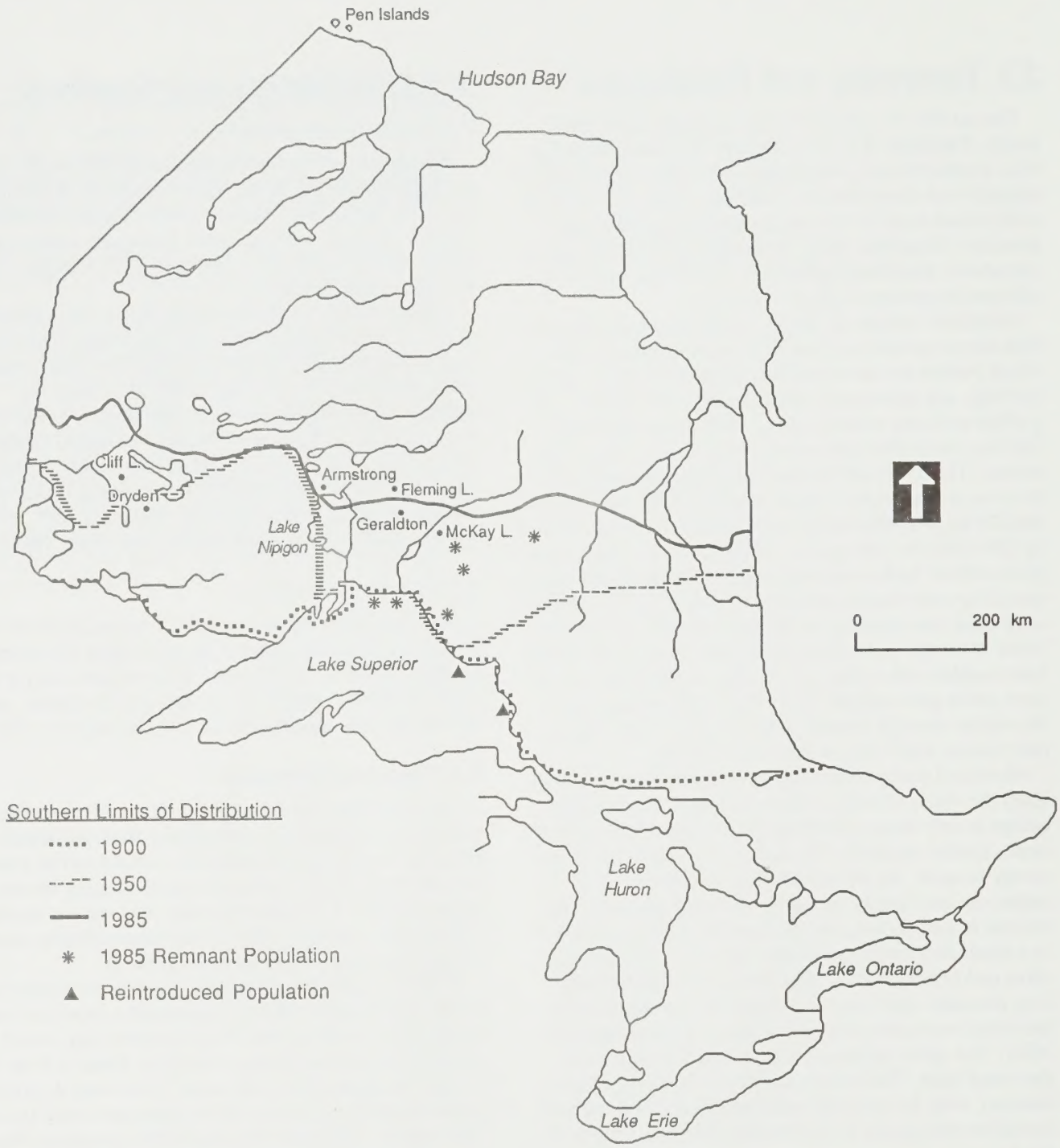

Figure 1: Distribution of woodland caribou in Ontario in 1900, 1950, and 1985 (deVos and Peterson, 1951; Darby and Duquette, 1985; OMNR, unpublished data).

Table 1: Recent woodland caribou population estimates for Ontario Ministry of Natural Resources' districts within current caribou range. Confidence intervals ($P < 0.10$) are shown where reported.

District	Population	District Estimate	Year	Reference
Cochrane	WMU 26	373 ± 345	1983	Armstrong (1983)
Geraldton	WMU 1D Kowkash Fleming L.	2709	1978	Hamilton (1978) Jackson (1981)
Hearst	Nagagami L. Ebbs-Orkney Tp.	22[a]	1983	OMNR (unpubl. data, Hearst)
Ignace	Seseganaga L.	7	1987	J. Carson (pers. comm)
Kapuskasing	WMU 25 Oke-Ford Tp.	80[a]	1984	Lucking (1979) OMNR (unpubl. data, Moosonee)
Kenora	Umfreville L. Snowshoe L. Eagle L. Werner L. Rd.	37[a]	1983	B. Ranta (pers. comm.)
Moosonee	District-winter Ft. Severn - Man. - summer	4528 ± 1075 4800[b]	1981-4 1986	Thompson (1986) OMNR (unpubl. data, Moosonee)
Nipigon	Onaman L. Ogoki Res. Armstrong Oboshkegan Wabakimi L.	278[a]	1978	(OMNR unpubl. data, Nipigon)
Red Lake	WPLUP Area	570	1978	OMNR (1982a)
Sioux Lookout	WPLUP Area	1750	1978	OMNR (1982a)
Terrace Bay	Caramat Coldwell Penn Flanders Tp. Hagarty Rd. Pic Is. Slate Is.	476[a]	1986	OMNR (unpubl. data, Terrace Bay)
Wawa	L. Superior Michipicoten Is. Pukaskwa N. Pk. Montreal Is.	52[a]	1986	OMNR (unpubl. data, Wawa)
PROVINCIAL TOTAL		15682[c]	1978-86	

a: These estimates are based on empirical data.

b: The relationship between summer and winter aggregations west of Ft. Severn is unclear. Caribou seen on the tundra in summer likely winter in Manitoba, hence are included here.

c: The provincial total is not a statistically based estimate; caution is required when comparing to previous provincial estimates.

The survey techniques, areas sampled and assumptions of these estimates differ among studies, and from those used to generate Table 1. Thus a direct comparison of estimates to determine population trend is not valid.

However, the similarity between Simkin's (1965a) estimate and the 1987 estimate in Table 1 is intriguing. It is important to note that no statistical confidence limits for the provincial estimates can be generated from available data.

2.3 Biology

2.3.1 Reproduction

Caribou take longer to mature than other cervids and do not have multiple births. Generally, female caribou become sexually mature at 2 1/2 years of age. However, a few breed as yearlings and some do not breed until 3 1/2 years or older (Bergerud, 1978). The average pregnancy rate of mature female caribou 2 1/2 years or older for seven different North American herds is 84% (Table 2).

In the Northwest Territories, Dauphine (1976) found that barren-ground caribou cows with poor fat reserves did not breed until 3 1/2 years of age or older. Age of first conception is related to condition in most cervid species (Verme, 1967, 1969; Clutton-Brock et al., 1982; Saether and Haagenrud, 1983).

Two estimates of pregnancy rate exist for Ontario caribou. Firstly, Simkin (1965a) reported a pregnancy rate of 75% for cows 1 1/2 years and older in the Patricia region of northern Ontario. He also found that calves comprised 16% of the winter population. Assuming yearlings comprise 16% of the adult population, pregnancy rate is therefore 89% for cows 2 1/2 years and older. Secondly, Gray (1978) estimated pregnancy rate of cows 1 1/2 years and older in the West Patricia region to be 63.5% between 1960 and 1969. If we again assume yearlings comprise 16% of the adult population, then pregnancy rate would be 76% for cows 2 1/2 years and older.

A factor that compensates for delayed maturity and single births in caribou is an adult sex ratio favouring females. The mean percent females of adult caribou in eight North American populations reported by Bergerud (1980) was 61%. The preponderance of females means that calves at birth comprise 27-30% of the population (Bergerud, 1980). The only information on the sex ratio of adult Ontario caribou comes from a small herd inhabiting Pukaskwa National Park that averaged 60% females over an eight year period (Bergerud, 1985).

Calf recruitment rates commonly obtained during late winter aerial surveys are important indicators of population growth potential. The proportion of calves in five North American caribou herds surveyed in late winter ranged from 10% to 16% (Table 3), and averaged 12.4% (Bergerud, 1974a). The proportion of calves in Ontario herds surveyed in winter ranged from 0.0 to 22.5% (Table 4) and averaged 12.8%.

Table 2: Reproductive rates of female caribou by age from nine North American herds (Bergerud, 1980).

	% Pregnant					% Parous[b]
Herd Name	Calf	1.5	2.5	3+	Total[a]	2+
Kaminuriak (NWT)	0(48)[c]	2(57)	48(69)	90(280)	81	82(343)
Beverly (NWT)	—	33(3)	50(16)	78(69)	73	—
Nelchina (AK)	0(24)	13(31)	61(46)	89(335)	86	86(3526)
W. Arctic (AK)	—	—	—	78(130)	78	92(517)
George R. (PQ)	—	100(1)	100(6)	100(15)	100	89(1279)
Spatsizi (BC)	—	—	—	—	—	80(3530)
Level Mt. (BC)	—	—	—	—	—	85(105)
Interior (NFLD)	—	—	—	—	81(21)	85(6657)
Porcupine (AK)	—	—	—	—	86(123)	—
TOTAL	0(72)	8(92)	55(137)	85(829)	84[a]	86

a: Excludes calves and yearlings

b: Observations made on calving grounds during immediate post-calving period. Some segregation of parous and non-parous cows may have occurred. The sample excludes calves from the previous year.

c: Sample size.

Table 3: Percentage calves found in late winter surveys of five North American caribou herds (Bergerud, 1974a).

Location & Years	Number of herds surveyed	Percentage calves in herd	
		Range	Mean
Ontario 1960-64	4	15-18	16
NW Territories 1955-61	6	7-25	15
George R., Labrador 1957-63	7	7-17	11
Kaminuriak, NWT-Man., 1967-69	3	9-11	10
Mealy Mt., Labrador 1957-63	7	3-15	10

Table 4: Estimates of population density and percentage calves for woodland caribou herds in Ontario derived from winter aerial transect surveys, 1959 to 1985. Confidence intervals ($P < 0.10$) are shown where reported.

Year	Survey Location	Area Sampled (km^2)	Caribou Density ($\#/km^2$)	% Calves	Reference
1984-85	Cochrane	29500	.014	—	Dawson & Payne (1985)
1981-84	Moosonee District	221164	.020 ± .005	—	Thompson (1986)
1975-85	Pukaskwa Nat'l Pk	—	—	18.9	Bergerud (1985)
1976-81	L. Nipigon	32000	.006	21.0	Cumming & Beange (1987)
1979	W. Patricia	223500	.014 ± .004	11.6	Hamilton (1979a)
1979	W. Patricia[a]	9445	.047	—	Hamilton (1979b)
1976	Irregular L.	4300	.011	4.3	English (1976)
1974	Irregular L.	4300	.008	0.0	English (1974)
1973	Irregular L.	4300	.006	4.0	Busch (1973)
1972	Big Trout L.	14117	.011	—	Buss & Barbowski (1974)
1971	Severn-Winisk	21760	.042	11.1	Buss (1971a)
1971	Irregular L.	4300	.008	11.8	Buss (1971b)
1968	Irregular L.	4300	.012	22.5	Hagan (1968)
1967	Severn-Winisk	21760	.022	18.8	Simkin (1967)
1967	Cliff L.	1600	.023	—	Hansson (1967)
1966	Big Trout L.	14117	.017	—	Simkin (1966)
1965	Irregular L.	4300	.020	—	Simkin (1965b)
1963	Irregular L.	4300	.006	—	Armstrong(1963)
1959-64	N. Ontario	293690	.021	16.7	Simkin (1965a)

a: High density wintering areas only.

To demonstrate gross productivity of Ontario caribou (gross population recruitment at calving) it is useful to refer to a hypothetical example. Let us assume:

(1) a starting population of 100 caribou during early May prior to calving;
(2) an adult sex ratio of 39 males:61 females (Bergerud, 1980);
(3) a recruitment rate of 0.128 to one year of age (i.e., net productivity) based on an average 12.8% calves observed in late winter aerial surveys (Table 4); and
(4) a fecundity rate for cows 1 1/2 years and older equal to 0.75 (Simkin, 1965a).

In early May, prior to calving, the population of 100 caribou is comprised of: 13 calves, 34 bulls (87.2 x 0.39) and 53 adult cows (87.2 x 0.61). During May, 40 new calves are born (53 x 0.75). The total number of caribou in the population is now 140. The gross productivity is therefore 28.6% [40/(40 + 100)]. Given the net productivity of 12.8%, or 14.7 calves per 100 adults (12.8 x 100/87.2), mortality in the first year of life is 63.3% [(40-14.7)/40)].

It is apparent from this example that calf mortality probably plays a major role in the population dynamics of Ontario's caribou as it does in many caribou herds across North America (Bergerud, 1980). It is important that any management of caribou in Ontario assess the magnitude and causes of calf mortality and attempt to alleviate this restriction to population growth.

There are examples of rapid population growth in caribou herds where calf survival is good due to the absence of predators and hunting. In Ontario, caribou introduced to Michipicoten Island in 1982 increased from 8 to 16 in three years with the observed rate of increase r=0.33 (Gord Eason, OMNR, Wawa, pers. comm.). In Newfoundland, Brunette Island caribou increased at r=0.35 from 1962 to 1967 (Bergerud, 1980). In Alaska: Adak Island caribou increased at r=0.25 from 1962 to 1968; St. George and St. Paul Island caribou increased at r=0.24 from 1911 to 1921, and; Kenai Peninsula caribou increased at r=0.27 from 1966 to 1972 (Bergerud, 1980).

2.3.2 Mortality

Predation is probably the most important mortality factor affecting Ontario's caribou. It has been suggested by Simkin (1965a) and argued by Bergerud (1974a), that the decline of caribou in Ontario in the early 1900's was a result of increased wolf predation. Moose expanded their range northward from 1880 to 1910 (Peterson, 1955). White-tailed deer did not invade northwestern Ontario until 1897 (Snyder, 1938). The increased ungulate density allowed higher wolf numbers, increasing predation on caribou, and resulting in a decline of caribou in the southern portion of their range. If we superimpose the present southern limit of continuous caribou distribution in Ontario on a map with the northern limit of high moose density, there is little overlap (Fig. 2). Figure 3 illustrates wolf densities across Ontario (Kolenosky, 1981); a gradient of high to low wolf density is apparent from south to north. Other significant predators of caribou are lynx (*Lynx canadensis*) (Bergerud, 1971) (Fig. 4), black bear (*Ursus canadensis*) and humans (see Section 2.5.1). Train collisions with caribou, common near the southern limits of distribution, can have a significant effect on small populations [e.g., 7 killed in Talbot township of a population of about 35 (OMNR, Hearst District unpublished data); 5 killed of about 25 in the Kowkash herd (Jackson, 1981)]. Automobile collisions with caribou are rare.

2.3.3 Behaviour

'Caribou', for many people, evokes images of vast herds that migrate long distances. Such dramatic behaviour appears to be a response to living in open habitats, and is not characteristic of the forest-dwelling populations of woodland caribou. For example, barren-ground caribou of the Northwest Territories, and woodland caribou of northern Quebec and central Newfoundland, live in open habitats throughout much of the year. They migrate hundreds of kilometers in spring, in large aggregations, to common calving areas in open habitats where predator densities are low. In summer they occupy open habitats where forage is nutrient-rich during the short but intense growing season. They rut in open habitats along treeline in autumn, then migrate back to forested habitats to winter.

In mountainous regions of British Columbia and the Yukon, woodland caribou undergo seasonal altitudinal migrations (Oosenbrug and Theberge, 1980; Bergerud *et al.*, 1984b). Calving on alpine tundra is considered an anti-predator strategy similar to that of calving on northern tundra (Bergerud *et al.*, 1984b). In both cases, caribou form large post-calving aggregations in open habitats, then migrate, and spend winter in smaller groups in forested habitat.

Some woodland caribou in Ontario occupy coastal tundra habitat from late winter through summer and early fall. In early June, 1986, the authors carried out an aerial reconnaissance survey along the Hudson Bay coast. A dispersed herd of more than 2,500 caribou was discovered near the coast opposite the Pen Islands, approximately 30 km east of the Manitoba border. Most of these caribou were cows and calves. Small groups of bulls were found scattered for at least 80 km into Manitoba.

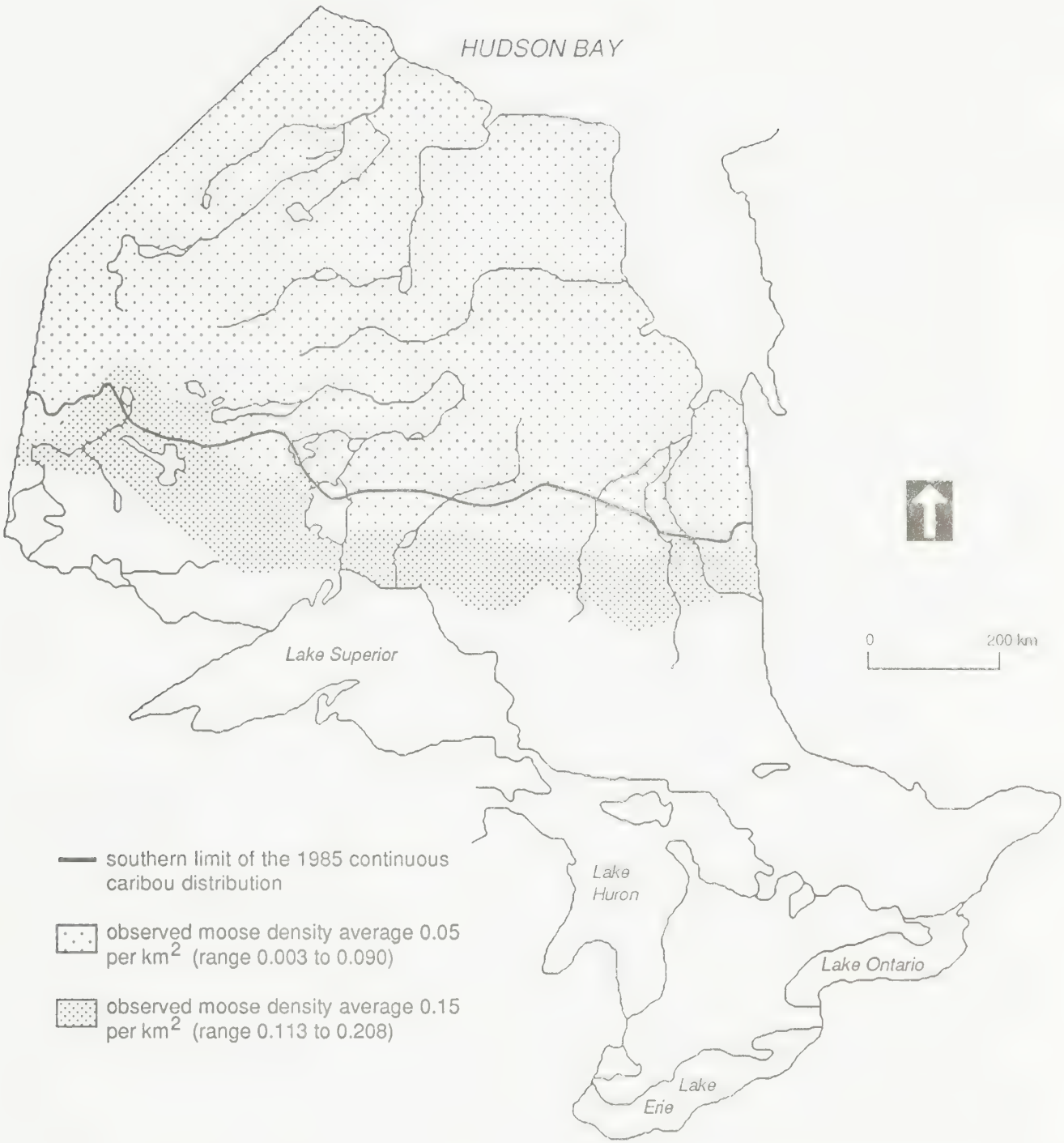

Figure 2: Relationship of the 1985 southern limit of continuous caribou distribution in Ontario to an abrupt northward decline in observed moose density of adjacent wildlife management units (Darby and Duquette, 1985; OMNR unpublished data 1975 to 1984).

Figure 3: Relationship of the 1985 southern limit of continuous caribou distribution to estimated density of timber wolves across Ontario (Kolenosky, 1981; Darby and Duquette, 1985).

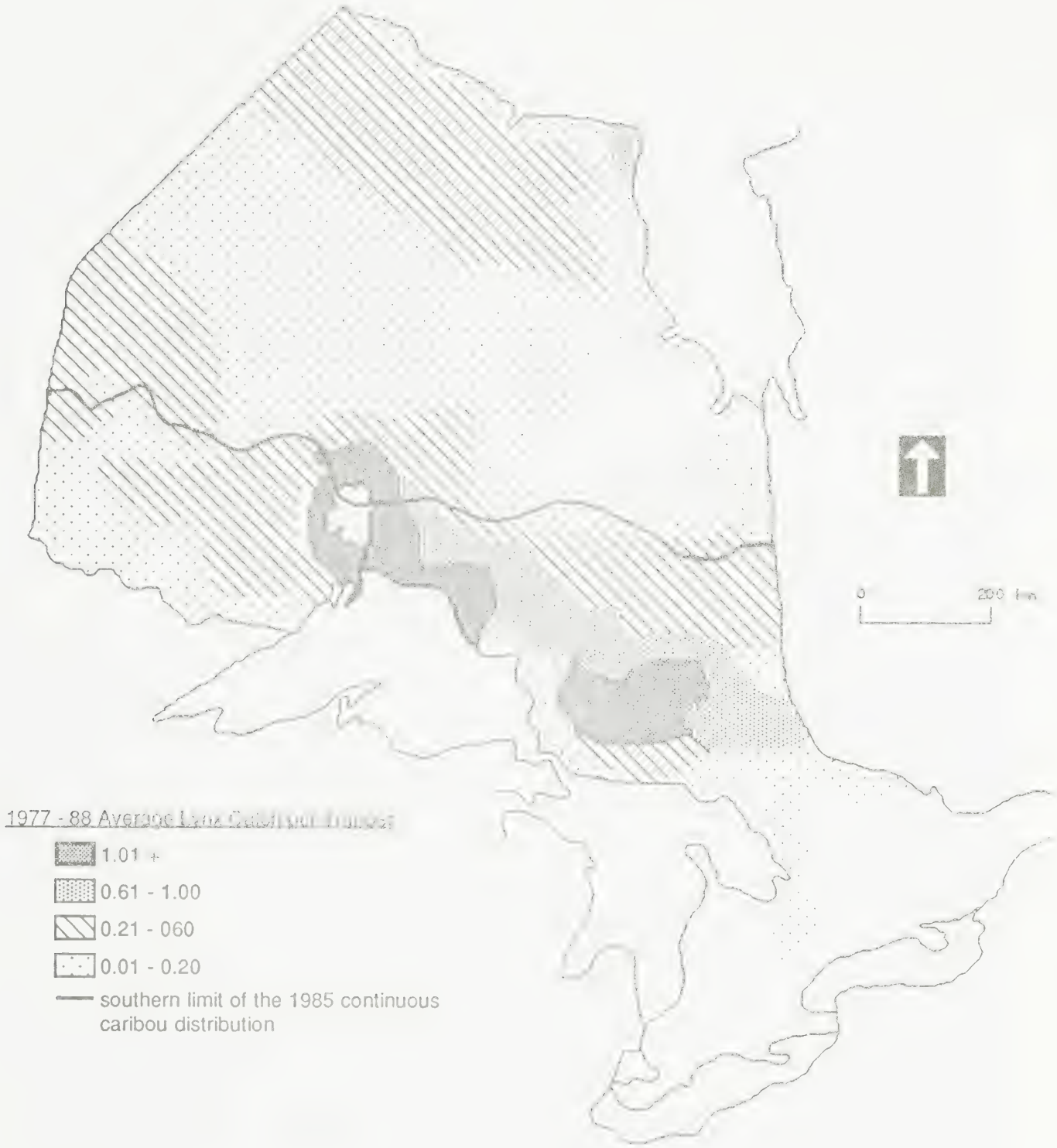

Figure 4: Relationship of the 1985 southern limit of continuous caribou distribution in Ontario to average lynx catch per trapper during the 1977-78 season (Quinn, 1984; Darby and Duquette, 1985).

Forest-dwelling woodland caribou have evolved other strategies to avoid predators during calving. At winter's end, cows disperse to secretive sites where concealment is provided by the forest, topography and waterbodies (Bergerud and Page, 1987). Caribou aggregations in open habitat may be analogous to this strategy because concealment of the individual may be provided by the constant movement and mixing of the herd (Estes, 1974; Bergerud, 1974b; Shoesmith, 1978).

In forest habitat at Reed Lake, northern Manitoba, Shoesmith and Storey (1977) found that woodland caribou cows commonly calve on islands or near mainland shorelines. In southeastern Manitoba, Darby and Pruitt (1984) found some caribou cows calved on islands while others calved on mainland locations. In Quebec and Labrador, Brown *et al.* (1986) found that almost all forest-dwelling cows calved on islands or on string bogs, usually returning to the same locations to calve in successive years.

In Ontario, Simkin (1965a) verified calving on islands in the Irregular Lake area. Nearly 100 of more than 200 caribou near Lake Nipigon move over ice to islands of the lake before calving, and remain there until after freeze-up when they return to mainland wintering areas (Cumming and Beange, 1987). In Pukaskwa National Park on the northeastern shore of Lake Superior, caribou calve near the coastline or on offshore islands (Bergerud, 1985). Caribou on Pic Island, Lake Superior, live in rugged terrain where they can seek altitudinal security if threatened by wolves (Ferguson, 1982). On the Slate Islands of Lake Superior, where large mammalian predators are absent, caribou exist at a density of seven to 11 per km^2, the highest density in North America (Bergerud, 1980).

It is evident from this summary that caribou cows seek islands, shorelines, bogs or rugged topography to calve as a strategy for predator avoidance and escape during spring and summer. This is apparently necessary to protect young calves from predation.

Average group size of forest-dwelling caribou populations varies throughout the year. In winter, average group size was 4.1 in Alberta (Fuller and Keith, 1981), 4.6 at Reed Lake, Manitoba (Shoesmith and Storey, 1977), 5.5 at Aikens Lake, Manitoba (Darby and Pruitt, 1984) and 10.6 at Lac Joseph, Quebec (Brown et al., 1986). In Ontario, mean winter group size was 2.9 at Pukaskwa National Park (Bergerud, 1985), 8.6 near Lake Nipigon (Cumming and Beange, 1987) and 9.1 in the Moosonee OMNR district (Thompson, 1986). During aerial caribou surveys across northern Ontario from 1959 to 1964, mean winter group size was 10.5 (Simkin, 1965a).

Forest-dwelling woodland caribou are essentially solitary during late spring and summer. They do not form large post-calving aggregations characteristic of barren-ground caribou. In the Birch Mountains of northeastern Alberta, average group size was 1.2 in July (Fuller and Keith, 1981). In Manitoba during summer it was 1.7 at Reed Lake (Shoesmith, 1978) and 1.2 at Aikens Lake (Darby and Pruitt, 1984). In Ontario, it was 1.5 at Pukaskwa National Park (Bergerud, 1985).

Simkin (1965a) collected information on monthly trends in mean group size of caribou by interviewing Native people in northern Ontario from 1959 to 1963. They reported that group size increased in September, remained relatively high through winter, declined in April or May prior to calving, and was just over 1 from June through August. This same trend has been observed in other forest-welling populations by Shoesmith and Storey (1977), Fuller and Keith (1981), Darby and Pruitt (1984) and Brown et al. (1986).

Range size occupied by forest-dwelling woodland caribou is also less than that occupied by open habitat populations. At Reed Lake, Manitoba, the individual range occupied by 11 radio-collared caribou averaged 253 km^2 in winter, 107 km^2 in spring and 13 km^2 in summer (Shoesmith and Storey, 1977). At Aikens Lake, Manitoba, the summer and autumn range for an adult cow was 28 km^2 and 56 km^2, respectively (Darby and Pruitt, 1984). In the Birch Mountains of northeastern Alberta, summer ranges for bulls and cows averaged 77 km^2 and 63 km^2 respectively; autumn ranges for bulls averaged only 23 km^2, and; winter ranges averaged 335 km^2 for bulls and 137 km^2 for cows (Fuller and Keith, 1981).

Seasonal range for entire populations has also been reported for some forest-dwelling situations. At Aikens Lake, Manitoba, a population of 30-40 caribou occupied 175 to 190 km^2 during summer and 95 to 140 km^2 during winter over a two year period (Darby and Pruitt, 1984). In a 32,000 km^2 study area at Lake Nipigon, Ontario, Cumming and Beange (1987) found that a population of more than 200 caribou wintered in scattered groups; wintering areas totalled 2,824 km^2 but averaged 390 km^2.

2.4 Habitat Use

2.4.1 Hudson Bay Lowlands

This is an area of flat topography and poor drainage extending 100 to 350 km inland from the Hudson Bay and James Bay coasts (Fig.5; cf. Rowe, 1972). It is comprised of two sub-types. Immediately adjacent to Hudson Bay is the Coastal Tundra Belt (Fig. 5), a narrow strip of tundra which is primarily treeless with some patches of stunted white spruce (Picea glauca) and black spruce (*P. mariana*) (Simkin, 1965a; Ahti and Hepburn, 1967; Rowe, 1972). Further inland is the Sub-Arctic Lichen Belt (Fig.5) characterized by open bogs and patterned fens interspersed with open black spruce-lichen woodlands and tamarack (*Larix laricina*) (Simkin, 1965a; Rowe, 1972). On riverbank levees, conifer and hardwood forests occur that are similar in composition and growth to the Boreal Coniferous Forest further south (Rowe, 1972). South of James Bay, conifer-lichen woodlands are scattered, and black spruce and tamarack swamps are common (Ahti and Hepburn, 1967).

There is a paucity of information on caribou in the Hudson Bay Lowlands. Movements of caribou in this area appear to be variable and complex (Simkin, 1965a). Some caribou calve and summer in the Coastal Tundra Belt, and winter in the Sub-Arctic Lichen Belt (Simkin, 1965a; K. Abraham, OMNR, Moosonee, Pers. comm.). Other caribou occupy the Sub-Arctic Lichen Belt year round (Simkin, 1965a).

Caribou that summer on the coast exhibit migratory and grouping behaviour similar to barren-ground caribou and woodland caribou that migrate between open and forested habitats (Kelsall, 1968; Bergerud, 1972; Dauphine et. al, 1975; Oosenbrug and Theberge, 1980). In spring, groups of pregnant cows migrate to the coastal tundra to calve, and other age/sex groups follow later. Post-calving aggregations of up to 4800 caribou occur during late spring and early summer (K. Abraham, Pers. comm.). During summer, most feeding activity occurs on relatively dry sites such as old beach ridges and frost-heaved areas where terrestrial lichens and the leaves of willow (*Salix* sp.) and bog birch (*Betula glandulosa*) are eaten. Cotton grass (*Eriophrum* sp.), sedges (*Carex* sp.) and bog bean (*Menyanthes trifoliata*) are important foods in wet areas (Simkin, 1965a). Post-calving aggregations break up in late July, and some movement away from the coast may occur. Some caribou rut near the treeline in late September and October (J. Thompson, OMNR, Moosonee, Pers. comm.).

Migration inland occurs in late fall, but it is not known if special migration routes or wintering areas exist. No caribou have been found wintering on the Coastal Tundra (Simkin, 1965a; Thompson, 1986).

Conversely, caribou that occupy the Sub-Arctic Lichen Belt year-round are essentially solitary in summer (Simkin, 1965a). This is typical of woodland caribou that occupy the Boreal Coniferous Forest (see below). Important summer foods of these caribou are willow, terrestrial lichens, cotton grass, horsetail (*Equisetum* sp.), bog birch, bog bean, and bog ericoids (Simkin, 1965a).

Both coastal and inland caribou winter in groups in the Sub-Arctic Lichen Belt. Brokx (1965) reported that most caribou winter in the central Lowlands on raised bogs where terrestrial lichens are abundant on ombrotrophic deposits of peat. Lichen woodlands, lichen heaths, palsa bogs and sinuously patterned peatlands are not selected. Terrestrial lichens, the staple winter food, are obtained by cratering through the snow, but bog ericoids, grasses, sedges, arboreal lichens and bog birch are also consumed (Simkin, 1965a).

2.4.2 Boreal Coniferous Forest

Extending south of the Hudson Bay Lowlands is a vast area of Boreal Coniferous Forest (Rowe, 1972) which spans the breadth of Ontario, south to the English River in the west, Lake Superior in the middle and Lake Abitibi in the east (Fig. 5). From west to east there is a gradual change from forests of black spruce, jack pine (*Pinus banksiana*) and poplar (*Populus* sp.) on broken relief of Precambrian granite ridges and intervening muskegs, to extensive forests of black spruce and muskeg on clay flats.

Woodland caribou inhabiting Boreal Coniferous Forest usually form groups of less than 50. Gregarious in autumn, winter and early spring, they are essentially solitary in late spring and summer (Simkin, 1965a; Shoesmith and Storey, 1977; Fuller and Keith, 1981; Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984). In general, caribou use of mature and over-mature pine (*Pinus* sp.) and spruce forest is high, whereas use of deciduous forest is low; open bogs, lakes and islands are preferred for foraging, escape and calving (Simkin, 1965a; Euler *et al.*, 1976; Shoesmith and Storey, 1977; Fuller and Keith, 1981; Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984). While caribou can use a variety of habitat types, they exhibit strong seasonal preferences governed by forage availability, predators and snow conditions.

In spring and summer, caribou feed on forbs, deciduous leaves, lichens, fungi, grasses and sedges (Simkin, 1965a; Bergerud, 1972). Where these foods are widely abundant, caribou use a greater diversity of habitats in spring and summer than in winter (Fuller and Keith, 1981; Darby and Pruitt, 1984). Spring dispersal of cows and calves,

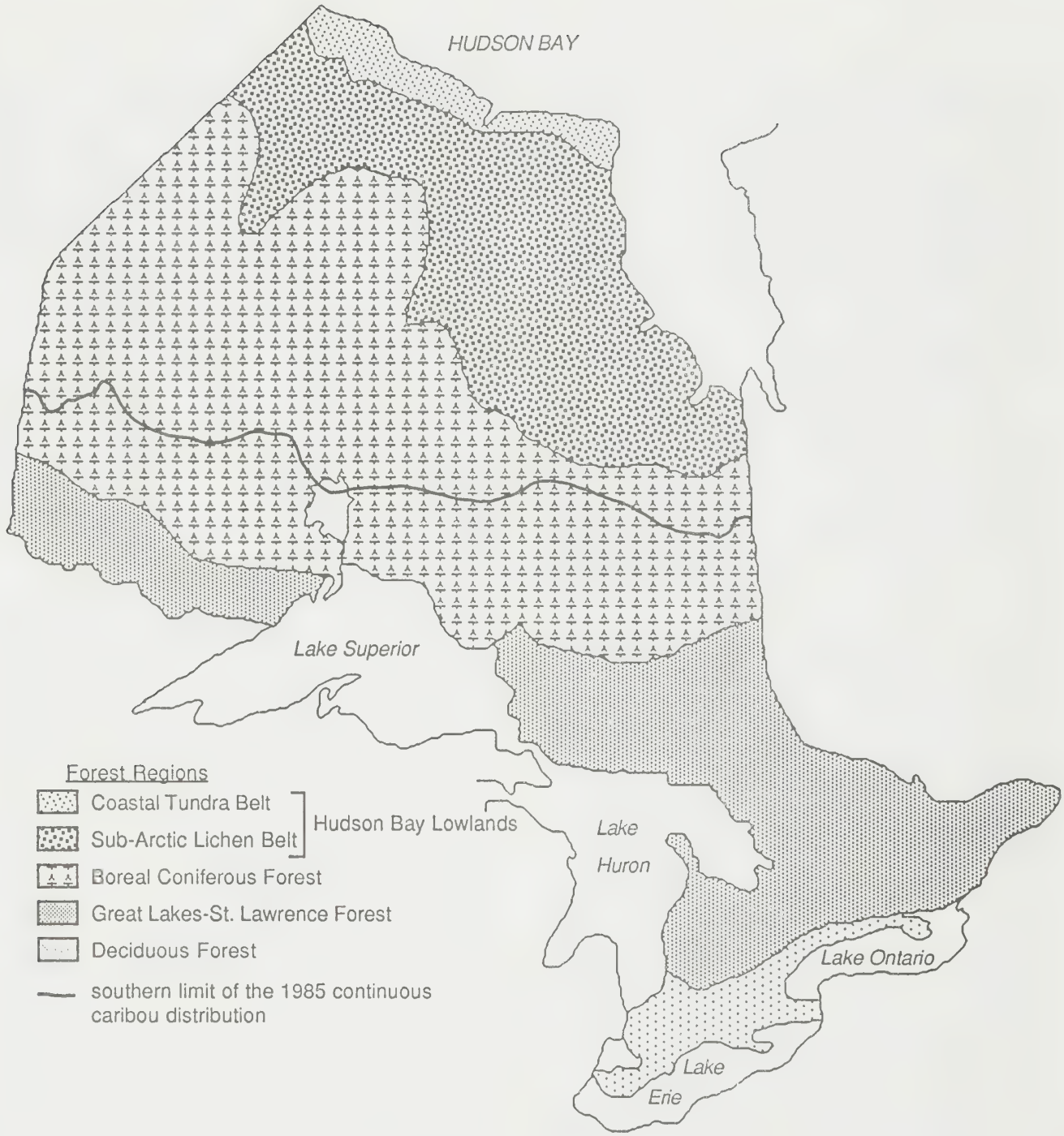

Figure 5: Relationship of the 1985 southern limit of continuous caribou distribution to the forest regions of Ontario (Simkin, 1965a; Rowe, 1972; Darby and Duguette, 1985).

and their use of open bogs, lakes and islands, may be anti-predator strategies (Simkin, 1965a; Shoesmith and Storey, 1977; Fuller and Keith, 1981). Similarly, caribou may use shorelines, open bogs and exposed ridges for relief from insects (Shoesmith and Storey, 1977; Edmonds and Bloomfield, 1984).

In autumn and winter caribou feed on arboreal and terrestrial lichens, sedges and bog ericoids; woody browse is not a dietary staple (Simkin, 1965a; Bergerud, 1972; Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984). Frozen lakes and creeks are used for travel, escape, resting and drinking slush water (Stardom, 1975; Fuller and Keith, 1981; Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984).

Although it has been argued that lichens are not essential for caribou survival (Bergerud, 1972; Euler *et al.*, 1976), they are a valuable winter food. During winter, caribou metabolic rate and protein requirements are reduced while carbohydrate demands are relatively high. Lichens, although low in protein, are rich in carbohydrates (Russell and Martell, 1984). Nutrients missing in lichens are contained in evergreen shrubs and graminoids consumed (Klein, 1982).

In some areas of Boreal Coniferous Forest woodland caribou may use traditional migration routes to move between summer and winter range (Stardom, 1977; Edmonds and Bloomfield, 1984), but fidelity to such routes is not strict. Stardom (1977) reported the Sasaginnigak herd in eastern Manitoba followed the same migration route in three of four years. In other areas caribou do not show cohesive and unidirectional movements and traditional routes do not appear to exist (Shoesmith and Storey, 1977; Fuller and Keith, 1981; Cumming and Beange, 1987). Individual or herd movements may be as great as 84 km (Edmonds and Bloomfield, 1984), but distances of 10-40 km are more common (Stardom, 1977; Fuller and Keith, 1981). Some caribou use the same range year round (Fuller and Keith, 1981; Darby and Pruitt, 1984; Edmonds and Bloomfield, 1984).

2.4.3 Great Lakes - St. Lawrence Forest

South of the Boreal Coniferous Forest, the Great Lakes-St. Lawrence Forest (Rowe, 1972) spans the breadth of Ontario, divided in two by Lake Superior (Fig. 5). It is a mixed forest of greater botanical diversity than its northern counterpart. Characterized by eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), eastern hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*), it also contains boreal species and such dominants as: eastern white cedar (*Thuja occidentalis*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), red oak (*Quercus rubra*), basswood (*Tilia americana*), and white elm (*Ulnus americana*).

The only populations of woodland caribou presently inhabiting Great Lakes - St. Lawrence Forest in Ontario are small introduced herds on Montreal and Michipicoten Islands in Lake Superior (Fig.1).

2.4.4 Forestry and Caribou

Woodland caribou in closed habitat occupy old growth, boreal coniferous forest. Caribou do not use woody browse as a staple winter food. In contrast, moose and white-tailed deer thrive in early successional forest; deciduous woody browse is the major portion of their diet in winter.

The importance of mature and over-mature coniferous forest to caribou conflicts with the forestry practice of clearcutting for paper production. Clearcut logging alters caribou habitat in more ways than simple reversion to an early successional stage unfavourable to slow-growing lichens. Stand conversion from coniferous to deciduous species may occur, especially where poplar (*Populus* sp.) are common. This is due to rapid vegetational reproduction of most deciduous trees and shrubs. Lichens, fungi and some ericoids are replaced by vasculars. Woody browse often proliferates, encouraging the growth of moose or deer populations, but not caribou . Increased moose and deer numbers cause increased wolf (*Canis lupus*) densities which result in increased predation rates on adjacent caribou (Bergerud and Page, 1987). Also, road access to caribou habitat is provided, facilitating native subsistence hunting, illegal hunting, and travel of wolves (Bergerud *et al.*, 1984a).

Reasons for the steady northward recession of caribou distribution in Ontario since European settlement are not clear, but it appears that a combination of factors has been involved. Logging, land clearing, fire and human disturbance may have forced caribou northward, or onto unsuitable range where their numbers declined (cf. Klein, 1968; Geist, 1978). Also, local populations may have been extirpated by hunting and increased predation and disease resulting from the growth of adjacent moose and deer populations (Anderson, 1971; Bergerud *et al.*, 1984a).

Since 1960 there have been several cases in northern Ontario where small groups of caribou (10 to 40) disappeared or were displaced when logging occurred in their range. Usually, documentation and data relating to these cases are poor or non-existent, for example at McKay Lake near Geraldton (Fig. 1). In three cases however, there are sufficient data to provide insight to the problem (Darby and Duquette, 1986).

Case 1: Fleming Lake, Geraldton District - For many years woodland caribou were known to winter near Fleming Lake north of Geraldton (Fig. 1). Twenty-one caribou were observed in December, 1981; other caribou were likely present but not observed (Mark Sobchuk, OMNR, Fort Frances, Pers. comm.). Forest composition of the winter range (170 km^2) was 61% mature and over-mature conifer (80 yrs or older), 11% immature conifer, 9% deciduous forest, 7% mixed forest, 8% muskeg and open land, and 4% water.

From 1980 to 1983, 1130 ha of mature and over-mature conifer were cut in a southern 7% of the winter range: 640 ha were clearcut, and 500 ha were modified with rows of uncut blocks 5 ha in size, spaced 200 m apart. The modified clearcut was intended to protect sandy soils from erosion, improve regeneration success and secondarily mitigate the effects of cutting on caribou (M. Sobchuk, Pers. comm.).

Nine aerial transect surveys (1.3 hr. each) were flown to monitor caribou distribution after cutting; one per month during December, January and February of 1981-82, 1982-83 and 1983-84. Results showed that caribou did not occupy any of the cuts. Instead, they were found in adjacent mature and over-mature jack pine north of the cuts where terrestrial lichens were abundant. Some caribou tracks were observed along the northern boundary of the cuts, but none were observed in the disturbed area to 1986 (M. Sobchuk, Pers. comm.).

No data are available on caribou reproductive or mortality rates for this area. There is no evidence of human harvest of caribou in this winter range despite frequent patrols by Conservation Officers. Moose density (0.12/km^2) did not increase after cutting and white-tailed deer are not present. Wolf density is low but unquantified. However, wolf predation of caribou is not likely to have increased after cutting, because moose density did not increase.

Case 2: Armstrong, Nipigon District - Since 1975 approximately 100 caribou have summered on islands in Lake Nipigon and most wintered on the mainland, some near Armstrong 10 to 50 km away from the islands (Fig. 1; Bergerud and Butler, 1975; Cumming and Beange, 1987; OMNR, unpublished data). The mainland winter range (180 km^2) is comprised of 35% mature and over-mature conifer, 26% immature conifer (mainly jack pine 40 to 79 yrs old), 11% deciduous forest, 17% mixed forest, 7% muskeg and open land, and 4% water. Most caribou activity in winter occurs on jack pine-spruce-lichen uplands. The community of Armstrong (population 500), a road and the Armstrong airport are located on northwestern and northern boundaries of the winter range.

From 1974 to 1985, several contiguous clearcuts totalling 1140 ha were made in mature and over-mature conifer in a western 6% of the winter range. Caribou have not used the cutovers since they were cleared, but continue to use adjacent uncut winter range (Blake Beange, OMNR, Nipigon, Pers. comm.). This was observed: on aerial transect surveys in 1983 and 1985 to monitor caribou winter distribution; on stratified random aerial quadrant surveys for moose in January 1976, 1979 and 1984, and; during casual observations of caribou and caribou tracks near the Armstrong airport adjacent to uncut winter range, but not in cutovers.

No data are available on caribou reproduction or mortality rates for this area. There is no evidence of human harvest of caribou in this winter range despite frequent patrols by Conservation Officers. Moose density immediately west of the winter range was 0.16/km^2 in 1976 and 0.24/km^2 in 1979. To the southwest it was 0.36/km^2 in 1979. White-tailed deer are not present in the area. Wolves are present but no information is available on their density. Caribou numbers appear unaffected by the increased moose density west of the winter range, so increased wolf predation of caribou does not appear to be implicated.

Case 3: Cliff Lake, Dryden District - Brousseau (1978) reported caribou disappeared from the Cliff Lake area northwest of Dryden (Fig. 1) after logging occurred in their winter range. Caribou had been known to exist there for many years. Six aerial transect surveys in winter 1966-67 showed the number of caribou exceeded 36 (Hansson, 1967). Brousseau (1978) described how the distribution and number of caribou subsequently receded as cutting occurred from 1968 to 1978. Four aerial transect surveys in March, 1978, showed approximately 12 caribou remained, wintering on uncut rocky jack pine ridges. Annual pellet group surveys (Brousseau, 1978) showed caribou density declined from 0.86 $\pm$ 0.35/km^2 ($P < 0.05$, n=318 plots) in 1972 to zero in 1978 (n=320 plots). Cutting in the area has continued to date. No caribou have been seen in Dryden district since 1978 (W. May, OMNR, Dryden, Pers. comm.).

The winter range calculated from MNR sightings of caribou and caribou tracks, 1968 to 1978 (Hansson, 1967; Brousseau, 1978), was 270 km^2. Before cutting, 39% was mature and over-mature conifer, 15% was immature conifer, 9% was deciduous forest, 11% was mixed forest, 9% was muskeg and open land, and 17% was water. By 1978, 15% was clearcuts, 60 to 1600 ha in size, scattered among lakes in central and eastern portions (33%) of the winter range. A road bisected the winter range, and large cuts and a road surrounded its eastern and northern margins. Cutting has continued in the area to date. Brousseau (1978) suggested the decline of possible emigration of caribou was due to logging. He speculated the reasons may have been direct, through habitat destruction and distrubance, or indirect through increased wolf predation and illegal hunting.

However, it appears other factors were involved. The density of white-tailed deer was high in the Cliff Lake area from the 1960's to approximately 1975 (W. May, Pers. comm.). No quantitative estimates of deer density are available for the Cliff Lake area, but deer density in a wintering area 50 km south was 8.6 $\pm$ 2.3 per km^2 in 1964. Moose density in the Cliff Lake area (0.18 $\pm$ 0.07 per km^2, $P < 0.10$) did not appear to increase during the period of caribou decline. There is no information on wolf density, but wolf-killed deer were commonly seen on the lakes. A high density of wolves may have increased predation rates on caribou. The meningeal worm may have been a mortality factor (Anderson, 1971) because deer densities were high for at least 5 years before the caribou started to decline. No evidence of human harvest of caribou was observed during patrols by Conservation Officers from 1972 to 1977, (Carl Hansson, OMNR, Dryden, Pers. comm.), even though Brousseau (1978) mentioned the possibility.

2.5 Harvest and Other Uses

2.5.1 Harvest

Caribou hunting, other than by Native people, has been prohibited in Ontario since 1929. No estimate of illegal harvest is available. Assessment of Native harvest has been historically through trapper's meetings (Simkin, 1965a), and more recently through interviews and questionnaires completed during land use planning initiatives (Gray, 1978; Thompson, 1986).

Major subsistence hunting occurs by coastal village Natives in the Hudson Bay Lowlands (400-500 caribou per year) and by interior village Natives in the northern portion of the Boreal Coniferous Forest (e.g., WPLUP area: maximum 150 caribou per year, Gray, 1978). Lower levels of Native harvest occur in other interior areas (Table 5).

In interior areas, Natives harvest an estimated two to seven percent of local caribou populations (Gray, 1978; OMNR, 1982a; OMNR, 1982b). Coastal Native communities may harvest as much as 12% of wintering caribou (Thompson, 1986). Further, due to the clumped distribution of caribou, particularly in winter, and because of Native hunting methods, local populations may be threatened by overharvesting (Simkin, 1965a; Thompson, 1986). Gray (1978) reported that 35% of caribou seen by Native hunters were killed.

Table 5: Estimates of annual Native harvest of caribou for Ontario Ministry of Natural Resources districts.

OMNR District	Herd or WMU	Annual Harvest	Year	Reference
Cochrane	WMU 26	10-15	1982	OMNR (1982b)
Geraldton	WMU 1C	90	1982	OMNR (1982c)
Hearst	Nagagami L.	0		S. St. Jules,
	WMU 18B	20-25[a]	1983-84	OMNR, Pers. comm.
Ignace		0		
Kapuskasing	WMU 25	0		
Kenora	WMU 2 & 6	0		
Moosonee	WMU 1A, 1B,		1974-77	
	1D, 25, 26	400-500	1981-83	Thompson (1986)
Nipigon	WMU 18A	20	1983	OMNR (1982d)
Red Lake	WMU 2, 1C	15-20	1982	OMNR (1982a)
Sioux Lookout	WMU 1C, 16A	55-60	1982	OMNR (1982a)
Terrace Bay		0		
Wawa		0		
Ontario Total		610-730[b]		

a: one complete herd killed
b: 4 to 5% of estimated Ontario population (Table 1).

2.5.2 Viewing

The mystique and wilderness quality of caribou hold high value for tourism. The factors creating good viewing opportunities are: natural settings, relatively high probability of encountering caribou or at least caribou sign, and a pleasant interpretive experience.

Several areas of the province have moderate or high potential for viewing caribou (Appendix 1). The island populations of Lake Superior, particularly Pic Island and the Slate Islands, represent excellent viewing opportunities near a heavily travelled tourist corridor. Woodland Caribou Provincial Park, Wabakimi Lake Provincial Park, and the Lake Nipigon Islands may have viewing potential at certain locations and times. Wilderness areas such as Polar Bear Provincial Park, the Pen Islands area of the Hudson Bay coast, and Kesagami Lake Provincial Park have more caribou than the southern sites; however, access is more difficult and the viewing opportunities could only be effectively provided through carefully controlled aerial tours.

The existence of woodland caribou in the province would surprise many Ontarians. The spectacular aggregations that occur seasonally along the Hudson Bay coast would capture the imagination of even seasoned travellers. There are significant opportunities for tourism promotion using caribou, and for viewing caribou, that are presently not being utilized.

2.5.3 Research

The historical decline of caribou in some parts of their range has been linked to factors including overhunting, increased natural predation, habitat destruction, human distrubance and disease (Anderson, 1972; Bergerud, 1974a; Geist, 1978). Bergerud (1985) studied dispersion and anti-predator strategies of caribou along the northern shore of Lake Superior. Dispersal and movements of caribou near Lake Nipigon were reported by Cumming and Beange (1987). A study of the population status and movements of the Pen Island herd of caribou along the Hudson Bay Coast was initiated by OMNR staff, Moosonee District in 1987.

Brokx (1965), Simkin (1965a) and Ahti and Hepburn (1967) conducted studies of caribou habitat in northern Ontario. Darby and Duquette (1986) reviewed three examples of caribou-forestry interaction in Ontario and suggested several mitigative techniques to reduce logging impact. Darby and Pruitt (1984) studied habitat use of a population of 30-40 woodland caribou in a study area straddling the Manitoba-Ontario border. Additional habitat related studies were conducted in the Armstrong-Lake Nipigon area by Bergerud and Butler (1975), Paulsen (1976a, 1976b), Antoniak (1979), Walroth (1980, 1981) and Cumming and Beange (1987).

Bergerud and his co-workers have been investigating the ecology of two island populations of caribou in Lake Superior; the Slate Islands (Bergerud and Butler, 1974; Butler and Bergerud, 1978; Dalton, 1985) and Pic Island (Ferguson, 1982). Lankester and his students at Lakehead University have been studying diseases and parasites of woodland caribou since the mid 1970's. Their work includes the description of nematodes (Lankester, 1976; Lankester *et al.*, 1976; Lankester and Northcott, 1979) and gastrointestinal helminthes of caribou (Lankester and Fruetel, 1986; Fruetel, 1987).

Bergerud (1974a, 1980) contended that caribou did not decline during the late 1800's and early 1900's due to a lack of lichens caused by habitat destruction and distrubance (Hypothesis I), but by increased mortality from hunting and predation (Hypothesis II). He proposed a test of these hypotheses: "Introduce caribou to an island lacking predators and lichens but having deciduous growth, sedges, and evergreen shrubs. Later, introduce wolves (before forage is overutilized)" (Bergerud, 1974a:769). He contended that Hypotheses I would be supported by a decrease in the caribou population prior to wolf introduction; Hypothesis II by a rise in population prior to wolf introduction, then a decrease as wolf predation increases (caribou forage must still be adequate to distinguish from Hypotheses I).

Bergerud's proposed test had a bearing on planning for reintroductions of caribou to areas where they could establish self-sustaining populations. Consequently, OMNR staff relocated two groups of eight Slate Island caribou to Michipicoten and Montreal Islands in 1982 and 1984 respectively, to perform Bergerud's test. Both islands were considered free of predators. By March 1987, Michipicoten caribou had increased to an estimated 20 to 25 animals; by fall 1987, Montreal Island caribou were estimated at 13 animals (G. Eason, OMNR, Wawa, Pers. comm.). A third relocation to Bowman Island, Lake Superior, where both wolves and deer exist, occurred in 1985 (Timmermann, 1985). These caribou were monitored with the use of radio-collars. Information derived from these studies will be valuable in formulating management strategies for rebuilding caribou populations elsewhere.

3.0 MANAGEMENT HISTORY

Early historical records indicate that white-tailed deer management was initiated in Ontario in 1821, but caribou received scant attention until after the turn of the 20th century. Concern for dwindling numbers of caribou in the 1920's resulted in hunting by non-Natives being prohibited in 1929. The season has remained closed since that time and management activity, while minimal, has been directed toward conservation and maintenance of the species. In the past three decades, management work has centered on population surveys, mortality assessment and research. Native harvest remains unregulated. Prohibition of non-Native hunting is enforced through normal enforcement patrols by field staff.

Five reviews of the status of Ontario caribou have been written (deVos and Peterson, 1951; Cringan, 1956: Simkin, 1965a; Bergerud, 1980; Darby and Duquette, 1986). There have been three large scale inventories over portions of caribou range in Ontario (Simkin, 1965a; Hamilton 1978, 1979a: Thompson, 1986), and numerous small scale inventories (see Section 2.2.3). Harvest assessments are summarized in Section 2.5.1 and research activities in Section 2.5.3.

Habitat management for caribou in Ontario has only been attempted since 1975. An attempt to modify logging practices to protect caribou habitat northwest of Dryden did not prevent disappearance of the herd (Brousseau, 1978). This and other attempts near Geraldton that basically applied moose habitat guidelines to caribou ended in failure. Attempts which restricted logging to peripheral portions of caribou range had more success (Darby and Duquette, 1986; cf. Section 2.4.4). Recently, OMNR draft habitat management guidelines for caribou have been developed (Chinook Consulting Co., 1985). Other recent efforts include relocating caribou to areas of former range (see Section 2.5.3), establishing Woodland Caribou Provincial Park (OMNR, 1986a) and proposing a public viewing site in Slate Islands Provincial Park (OMNR, 1986b).

4.0 SPECIFIC ISSUES

4.1 Awareness of the Resource

Ontario woodland caribou presently have low intrinsic value in the public mind. The public is generally unaware that caribou inhabit the province. This lack of awareness is an issue.

4.2 Mitigation of Forestry Effects on Caribou

At Fleming Lake and Armstrong (Fig. 1, see Sec. 2.4.4) it appears logging caused displacement of caribou from peripheral portions of their range, yet range abandonment did not result and caribou numbers did not decline. At Cliff Lake the disappearance of caribou probably resulted from a combination of factors: habitat destruction, predation, and possibly disease involving meningeal worm (Anderson, 1971).

Cutting of most mature conifer in an area may leave caribou no option but emigration. Small patch cutting, on the other hand, does not mitigate caribou displacement and may increase access for hunters and wolves, may increase moose and deer densities, and consequently increase wolf numbers. In Alberta, forest-dwelling (vs. mountain) caribou did not feed in clearcuts larger than 2 ha and were known to cross a larger cut only once in four years (Edmonds and Bloomfield, 1984).

While the above information does not clearly identify the reasons for caribou displacement or decline, it does indicate the important need to develop techniques to mitigate the effects of forestry on caribou (cf. Darby and Duquette, 1986). In view of the recent expansion of logging into previously remote areas of northern Ontario, the shrinking distribution of caribou is an issue.

4.3 Relocation of Caribou

Small remnant populations of woodland caribou still exist along the northern shore of Lake Superior and on its associated islands (Euler *et al.*, 1976; Ferguson, 1982; Bergerud, 1985). Eason (1982, 1984) stated that caribou living near the Lake Superior shoreline near Wawa were in danger of extirpation because of their small numbers. He and others believe a good case can be made for protecting and increasing caribou numbers as well as determining factors responsible for their decline. This can be achieved by supplementing small existing populations and establishing new ones in areas of former range, where they could be self-sustaining, through relocation of animals. Candidate stocking sites should be carefully researched to ensure they were formerly occupied by caribou, suitable habitat conditions for caribou currently exist, predation is minimal and deer numbers are low.

Caribou intended for relocation can be obtained from populations that periodically exceed their carrying capacity. Slate Islands Provincial Park offers such an opportunity. In recent years, the estimated caribou population on the Slates has fluctuated from ± 600 in 1983-84 to ± 300 in 1985-86, on a land area of 36 km².

Capture and handling practices must conform to requirements issued under the Animals for Research Act 1972. Legislation, policies and procedures outlined in the Provincial Parks Act, North Central Regional Park Research Plan, and the Slate Island Provincial Park Master Plan must be recognized and followed. Relocation projects of this nature are regarded by the Ministry of Environment as research, as defined in Regulation 293 of the Environmental Assessment Act. Regulation 293, Section 12, exempts research undertakings from provisions of the Act (L. Stevens, OMOE, pers. comm.). The capture and handling of caribou may be an issue.

4.4 Predator Management

Predation may significantly depress caribou numbers in certain cases. This is an important management concern where Native harvest is high or where habitat disturbance has caused an increase in moose or deer numbers. In special circumstances where predators are contributing disproportionately to total mortality of caribou, selective efforts can be applied to reduce numbers of specific predators. Control of moose and deer numbers may also be necessary. Predator control is likely to be a controversial issue.

4.5 Harvest

Native people's harvest of caribou is unregulated. In most of the Ontario caribou range this harvest does not appear excessive, but in some areas it may exceed sustained yield (Thompson, 1986).

Non-native harvest of caribou is presently prohibited in Ontario, but many of the conditions that required season closure in 1929 no longer exist. Evidence that Ontario caribou populations are below carrying capacity of the range (Ahti and Hepburn, 1967), better inventories, modern management techniques such as selective harvest (e.g., trophy bulls only in specific wildlife management units) and the opportunity to increase recreational and economic benefits to northern Ontario society suggest the sport hunting closure be re-evaluated.

Thus, two provincial issues related to caribou harvest exist:

(1) re-evaluation of the rationale for the season closure for sport hunting in 1929 in light of information and experience acquired since that time; and
(2) the economic value of caribou to Native people through subsistence use versus trophy sport hunting opportunities marketed by Native people.

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6.0 APPENDICIES

6.1 APPENDIX 1: Potential woodland caribou viewing areas in Ontario.

Location & OMNR District	Type Opportunity	Constraints on Viewing	Potential for Tourism
Kesagami L. Cochrane	Fly-in canoe or boat trip, Prov. P,.	Fly-in only, scattered caribou in summer	Low
Kattawagami-Detour L. Cochrane	Self-accessed by road - fall & spring migration	Road condition	Low
Michipicoten Is. Wawa	Charter boat, aircraft Prov. Park	Small herd, weather	Moderate
Montreal Is. Wawa	Charter boat telescope from Trans-Canada Hwy. Lookout Prov. Park	Small herd, weather	High
Pukaskwa Nat'l Pk., Wawa	Vehicle access Nat'l Park	Small herd	Moderate
Pic Islands Terrace Bay	Boat	Small herd, weather	High
Slate Islands Terrace Bay	Charter boat, aircraft, Prov. Park	Weather, access	High
Nipigon Islands Nipigon	Boat, self-access	Weather, scattered caribou, disturbance	Low
Wabakimi L. Nipigon	Winter, Prov. Park	Elusive herds, may require carefully regulated air tour	Low-Moderate
Woodland Caribou Park Red Lake	Prov. Park canoe, fly-in or air tour	Scattered caribou in summer, elusive herds in winter	Moderate-High
Polar Bear Prov. Park Moosonee	Fly-in, or air tour, Cree guide	Cost, few caribou carefully regulated air tour	Moderate
Pen Islands Moosonee	Wilderness tundra, fly-in Cree guide or air tour	Cost, summer only, carefully regulated, disturbance	High

6.2 APPENDIX 2: Summary of Native peoples' harvest of Ontario woodland caribou by community, 1960 to 1984.

	Community[a,b]												
	Coastal							Interior					
Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
60-61	—	—	—	—	—	—	—	—	2	—	—	—	2
61-62	—	—	—	—	—	—	—	—	2	3	—	—	5
62-63	—	—	—	—	—	—	—	—	6	—	—	—	6
63-64	—			—	—	—	—	—	7	1	—	—	8
64-65	61		18	—	—	—	—	—	2	—	—	7	88
65-66	92		25	—	—	14	—	—	—	—	—	15	152
66-67	98		41	—	—	10	—	—	3	2	—	2	156
67-68	48		37	—	—	3	—	—	13	—	—	1	102
68-69	53		39	—	—	9	—	—	1	—	—	—	102
69-70	63		30	—	—	2	—	—	1	—	—	—	96
70-71	52		129	—	—	1	—	—	2	6	—	—	190
71-72	21		25	—	—	2	—	—	11	21	—	—	80
72-73	60		36	—	—	8	—	—	27	3	—	10	144
73-74	43		22	—	—	—	—	—	7	—	—	—	72
74-75	43	47	20	—	—	15	96	—	3	—	—	—	224
75-76	61	7	26	—	—	6	127	—	—	—	—	—	227
76-77	71	10	38	63	—	9	151	—	7	—	1	—	350
77-78	—	—	—	—	—	—	—	—	1	11	5	29	46
78-79	—	—	—	—	—	—	—	—	—	—	—	—	—
79-80	—	—	—	—	—	—	—	—	—	—	—	—	—
80-81	—	—	—	—	—	—	—	—	—	—	—	—	—
81-82	46	60	33	—	—	1	38	—	—	—	—	—	178
82-83	199	14	41	—	1	—	51	—	—	—	—	—	306
83-84	—	—	—	—	—	—	—	28	37	—	—	—	65

a: Communities are numbered as follows: 1 = Attawapiskat; 2 = Ft. Albany; 3 = Kasheshwan; 4 = Ft. Severn; 5 = Moose R.; 6 = Moosonee/Moose Factory; 7 = Winisk; 8 = Big Trout Lake; 9 = Kasabonika; 10 = Landsdowne House; 11 = Summer Beaver; 12 = Webequie.

b: References are: communities 1 to 7 - Thompson (1986); communities 8 & 9 - Ross (1985); communities 9 to 12 - Jackson (1981).

6.3 Appendix 3: Bibliography of Ontario Caribou Reports and Publications

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